Generalized additive model for comparing wind tunnel and bLS measurements

Sasha D. Hafner

13 May, 2022

Data

Focus on early times, exclude first 2 hours to avoid underestimation period.

```
idat$j.NH3[idat$j.NH3 <= 0] <- 1E-4
idat$trial <- factor(idat$app.date)
ds1 <- subset(idat, cta <= 48 & cta >= 2)
```

Fit models

```
mods <- list()
```

```
i <- 1
mods[[i]] <- gam(log10(j.NH3) ~ (wind.2m + air.temp) * meas.tech2 +
                 s(cta) + rain.rate + rain.cum + trial, data = ds1)
```

```
summary(mods[[i]])
```

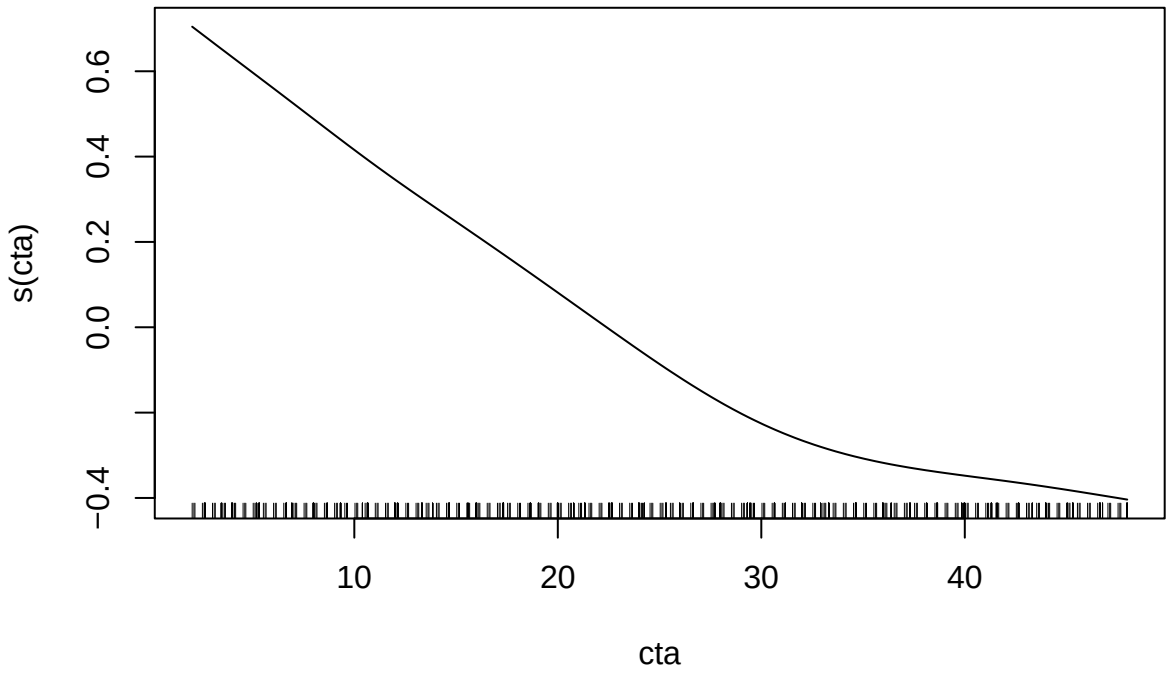
```
##
## Call: gam(formula = log10(j.NH3) ~ (wind.2m + air.temp) * meas.tech2 +
##     s(cta) + rain.rate + rain.cum + trial, data = ds1)
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.05016 -0.07018 -0.00870  0.08234  0.52022
##
## (Dispersion Parameter for gaussian family taken to be 0.027)
##
##     Null Deviance: 168.9559 on 973 degrees of freedom
## Residual Deviance: 25.9372 on 960.0002 degrees of freedom
## AIC: -737.3721
##
## Number of Local Scoring Iterations: NA
##
## Anova for Parametric Effects
##                      Df  Sum Sq Mean Sq   F value    Pr(>F)
## wind.2m               1   2.257   2.257   83.5531 < 2.2e-16 ***
## air.temp              1   2.888   2.888  106.9036 < 2.2e-16 ***
## meas.tech2            1  14.465  14.465  535.4023 < 2.2e-16 ***
## s(cta)                1 107.697 107.697 3986.1318 < 2.2e-16 ***
## rain.rate             1   0.108   0.108    3.9828 0.0462491 *
```

```
## rain.cum              1   3.380   3.380  125.1013 < 2.2e-16 ***
## trial                 2   4.025   2.012   74.4787 < 2.2e-16 ***
## wind.2m:meas.tech2    1   0.320   0.320   11.8472 0.0006024 ***
## air.temp:meas.tech2   1   0.043   0.043    1.5917 0.2073922
## Residuals           960  25.937   0.027
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Anova for Nonparametric Effects
##                     Npar Df Npar F     Pr(F)
## (Intercept)
## wind.2m
## air.temp
## meas.tech2
## s(cta)                    3 77.702 < 2.2e-16 ***
## rain.rate
## rain.cum
## trial
## wind.2m:meas.tech2
## air.temp:meas.tech2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
coef(mods[[i]])
```

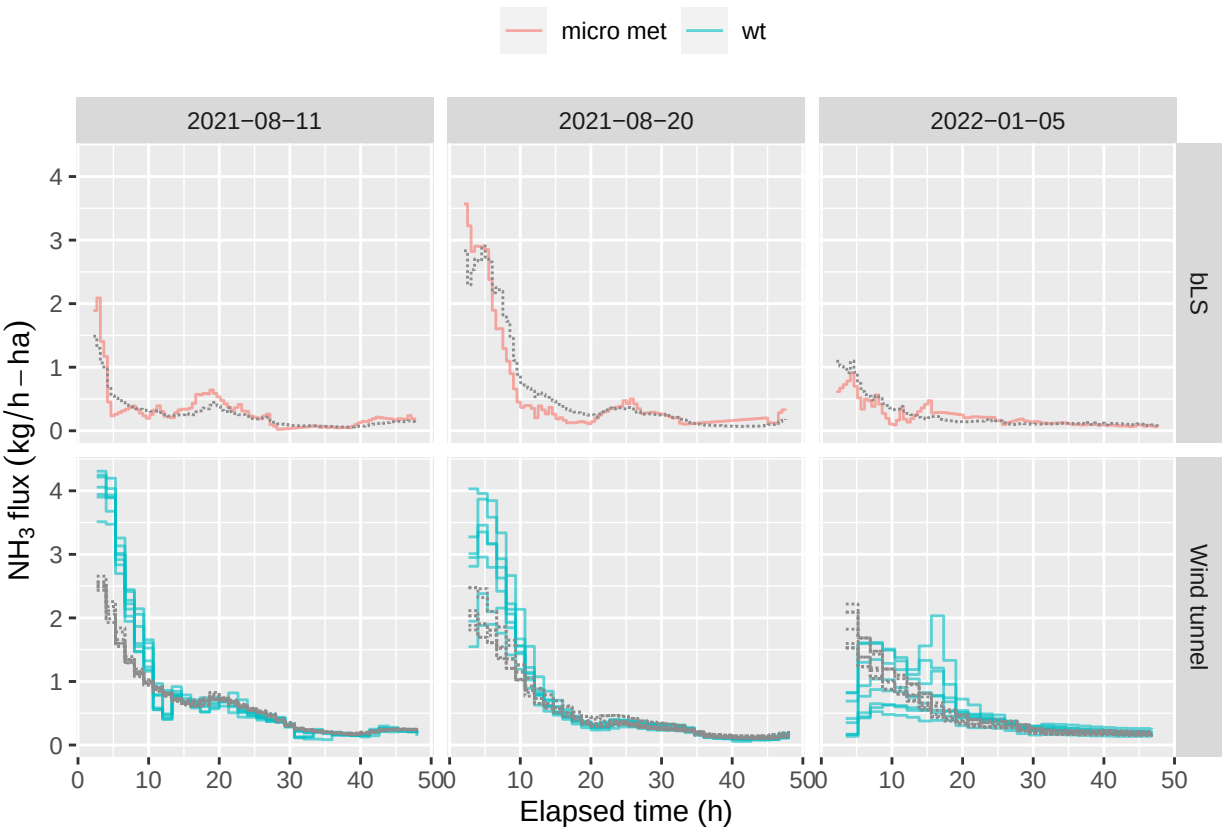
```
##           (Intercept)               wind.2m              air.temp
##          -0.432491033           0.110301898           0.030377465
##          meas.tech2wt                s(cta)            rain.rate
##           0.173407403          -0.025158966          -0.105192771
##              rain.cum       trial2021-08-20       trial2022-01-05
##          -0.065607019          -0.003620441           0.370464580
##  wind.2m:meas.tech2wt air.temp:meas.tech2wt
##           0.108843979          -0.001919534
```

```
plot(mods[[i]], terms = 's(cta)')
```




```
ds1[, paste0('j.NH3.pred', i)] <- 10^predict(mods[[i]])
```

```
ggplot(ds1, aes(cta, j.NH3, group = pmid, colour = meas.tech2)) +
  geom_step(alpha = 0.6) +
  geom_step(aes(cta, j.NH3.pred1), colour = 'gray55', lty = '11') +
  facet_grid(meas.tech ~ app.date, scale = 'fixed') +
  labs(x = 'Elapsed time (h)', y = expression('NH'[3]~'flux'~(kg/h-ha)), colour = '') +
  theme(legend.position = 'top')
```


micro met
wt
2021−08−11
2021−08−20
2022−01−05
bLS
Wind tunnel
NH_3 flux (kg/h−ha)
Elapsed time (h)
0
1
2
3
4
10
20
30
40
500
50